POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
RAMS analysis of rail vehicles [S2MiBP1-PSz>RAMS]

Course

Field of study	Year/Semester
Mechanical and Automotive Engineering	2/3
Area of study (specialization)	Profile of study
Railway Vehicles	general academic
Level of study	Course offered in
second-cycle	polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	0	0
Tutorials	Projects/seminars	
15	15	

Number of credit points

3,00

Coordinators	Lecturers
dr hab. inż. Adrian Gill adrian.gill@put.poznan.pl	

Prerequisites

The student starting this course has knowledge of the construction, manufacture, operation of rail vehicles and the use of basic probabistic and statistical models. The student has the ability to obtain information from the indicated literature sources. Is aware of the need to have knowledge and skills in the field of reliability and safety assessment of rail vehicles and their systems in order to obtain employment in railway companies and related to local public transport.

Course objective

Learning methods, processes, procedures and models in the field of reliability and safety analyzes in rail vehicles and rail vehicle systems and acquiring the ability to use them.

Course-related learning outcomes

Knowledge:
Has extended knowledge of mathematics in the field of numerical methods used in optimization tasks, computer simulation, linear algebra, interpolation and approximation.
Has extended knowledge of the standards for working machines in the field of methods of calculating and testing machines, safety, including road safety, environmental protection as well as mechanical and

electrical interface.
Has extended knowledge of the life cycle of machines, the principles of operation of working machines and destructive processes occurring during operation, such as tribological wear, corrosion, surface fatigue and volumetric aging of the material.

Skills:
He can design the technology of exploitation of a selected machine with a high degree of complexity.
Can write user manual and safety manual for designed work machine or vehicle.
He can estimate the potential threats to the environment and people from the designed working machine and vehicle from a selected group.

Social competences:
Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on its own.
It is ready to initiate actions for the public interest.
Is ready to fulfill professional roles responsibly, taking into account changing social needs, including:
- developing the professional achievements,
- maintaining the ethos of the profession,
- observing and developing the rules of professional ethics and acting towards the observance of these rules.

Methods for verifying learning outcomes and assessment criteria
Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified on the basis of a written exam. The lecturer determines the result of the exam. Completion of the content of exercises is carried out in the form of a written test at the last classes. The test consists of 8-10 questions (test and open-ended) with different scores. The grade for completing the project classes reflects the substantive and editorial level of the project submitted for evaluation, and is determined by the person conducting the project classes.

Programme content

Lecture. Introduction to RAMS analyzes (Reliability / Reliability, Availability / Readiness, Maintainability / Maintainability, Safety / Security). Reliability analyzes (RAM) in RAMS analyzes of rail vehicles. Structural reliability issues. Reliability of components as objects of non-renewed rail vehicles. Availability and maintainability of components as objects of renewable rail vehicles. Estimating the demand for components and renewable rail vehicle components. Safety analysis (S) in RAMS analyzes of rail vehicles. Risk management at the stage of project concept, design, production, use and maintenance, liquidation and utilization. Risk management methods. Selection of the area of analysis. Safety system identification. Hazard identification processes. Risk models and risk risk estimation. Responding to the risk of threats.
Exercise. Determining the reliability of components and systems of rail vehicles in terms of structural reliability. Determining the value of the reliability characteristics of non-renewed components of rail vehicles. Determining the availability and maintainability measures of the components of the renovated rail vehicles. Overview of the content and rules of application of Regulation 402/2013 on a common safety method in the field of risk evaluation and assessment.
Design. Characteristics of the analyzed system (purpose of operation / appropriate applications / working conditions, description of system components, operating modes, expected durability of the system and its components); determining the requirements and functions of the system; development of a hazard register, taking into account the impact of the environment or system environment and interactions with other systems; evidence of compliance at the system level and the level of its components with regard to the RAMS components using RAMS characteristics and indicators; specification of safety system components, including in connection with planned and unplanned maintenance activities.

Teaching methods

Lecture with the use of multimedia presentations.
Classes: electronic presentations at the stage of formulating problems to be solved, solving fragments of problems on the board by students, a visit to a branch of the Rail Transport Office.
Project: electronic presentation in the phase of project formulation and implementation examples of its components, consultation of the project implementation phases with the person conducting and partial

implementation of the project during the classes, implementation of a part of the project scope outside the time of project classes.

Bibliography

Basic

1. Chruzik K., Inżynieria bezpieczeństwa w transporcie. Wyd. Politech. Śląskiej, Gliwice, 2016.
2. Gill A., Warstwowe modele systemów bezpieczeństwa do zastosowań w transporcie szynowym. Wyd. Politechniki Poznańskiej, Poznań, 2018.
3. Inżynieria niezawodności. Poradnik pod red. J. Migdalskiego, Wyd. ATR Bydgoszcz i Ośrodek Badań Jakości Wyrobów "ZETOM", Warszawa, 1992.
4. Kadziński A., Studium wybranych aspektów niezawodności systemów oraz obiektów pojazdów szynowych. Wyd. Politechniki Poznańskiej, seria Rozprawy, nr 511, Poznań, 2013.
5. Karpiński J., Korczak E., Metody oceny niezawodności dwustanowych systemów technicznych. Wyd. Omnitech Press, Instytut Badań Systemowych, Warszawa, 1990.
6. Kadziński A., Zarządzanie ryzykiem zagrożeń na stanowiskach pracy. Rozdział 3 w: praca zbiorowa red. L. Lewicki, J. Sadłowska-Wrzesińska, Istotne aspekty BHP. Wydawnictwo Wyższej Szkoły Logistyki, Poznań, 2014, s. 149÷195.
7. Niziński S., Eksploatacja obiektów technicznych. Wydawnictwo Naukowe Instytutu Technologii Eksploatacji – PIB, Warszawa – Sulejówek – Olsztyn – Radom, 2002.
8. Poradnik niezawodności. Podstawy matematyczne, Wydawnictwa Przemysłu Maszynowego „WEMA", Warszawa, 1982.
9. Zintegrowany system bezpieczeństwa transportu. III tom Koncepcja zintegrowanego systemu bezpieczeństwa transportu w Polsce. Praca zbiorowa – red. R. Krystek, Politechnika Gdańska, WKŁ, Warszawa, 2010.

Additional

1. Daliga M., Przegląd międzynarodowych standardów i metodyk zarządzania ryzykiem w przedsiębiorstwie. Inprogress 2011, http://www.4pm.pl/upload/artykuly/InLab.pdf
2. Kaczmarek T.T., Ryzyko i zarządzanie ryzykiem. Ujęcie interdyscyplinarne. Wyd. Difin, Warszawa 2006.
3. Kosieradzka A., Zawiła-Niedźwiecki J., Zaawansowana metodyka oceny ryzyka w publicznym zarządzaniu kryzysowym. Wydawnictwo edu–Libri, Kraków-Legionowo, 2016.
4. Kosmowski K. (red.), Podstawy bezpieczeństwa funkcjonalnego. Wyd. Politechniki Gdańskiej, Gdańsk 2015.
5. Mahboob Qamar, Zio Enrico, Handbook of RAMS in Railway Systems. Theory and Practice. March 29, 2018 Forthcoming by CRC Press.
6. Markowski A. S., Zarządzanie ryzykiem w przemyśle chemicznym i procesowym. Wydawnictwo Politechniki Łódzkiej, Łódź, 2001.
7. Sowa A., Teoria eksploatacji i diagnostyka pojazdów szynowych. Zagadnienia wybrane. Wyd. Politechniki Krakowskiej, Kraków, 2019.
8. Szkoda M., Kształtowanie potencjału przewozowego przedsiębiorstw transportu kolejowego. Monografia, Wyd. Politechniki Krakowskiej, Kraków, 2017.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00